Ordering number: EN982C

Monolithic Linear IC

LA2000

Audio Level Sensor

Overview

LA2000 is an IC for detecting interprogram spaces to pick out the starting point of a program immediately preceding or following a musical program recorded on tape, and to detect end of tape.

Used in

- Radio-cassette recorders
- Cassette decks
- Car stereos

Applications

- Detection of spaces between programs recorded on tape
- Detection of end of tape
- Other

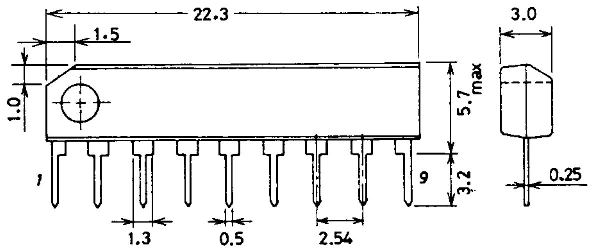
Features

- Has transistors capable of driving plungers with maximum 600 mA, and a protective diode to prevent induced reverse voltages.
- Can provide designated time delays by externally connected capacitors and resistors.
- Has a comparator with stable hysteresis to handle variations in power supply voltage.
- Detects unrecorded portions of tape.

Package Dimensions

unit : mm

3017B-SIP9



Specifications

Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		15	V
Allowable power dissipation	Pd max		540	mW
Flow-in current	I_6 max		600	mA
Operating temperature	Topr		–20 to +75	°C
Storage temperature	Tstg		–40 to +125	°C

Note: 1. The voltage at pin 8 must not exceed the supply voltage at pin 9.
2. The maximum current flowing into pin 8 should be no greater than 0.5 mA.

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Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Operating voltage range	V_{CC} op		3.5 to 14	V

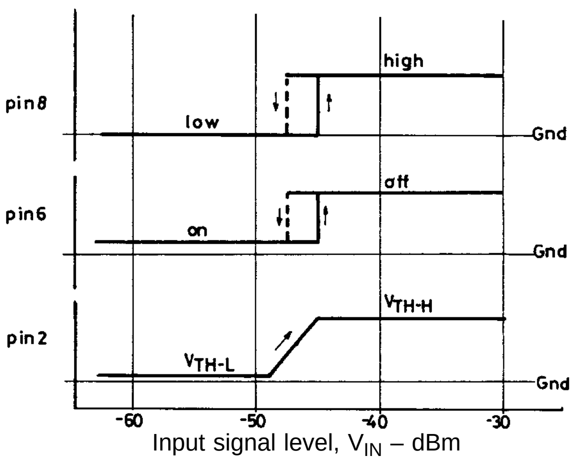
Electrical Characteristics at Ta = 25°C, V_{CC} = 9.0 V, f = 1 kHz

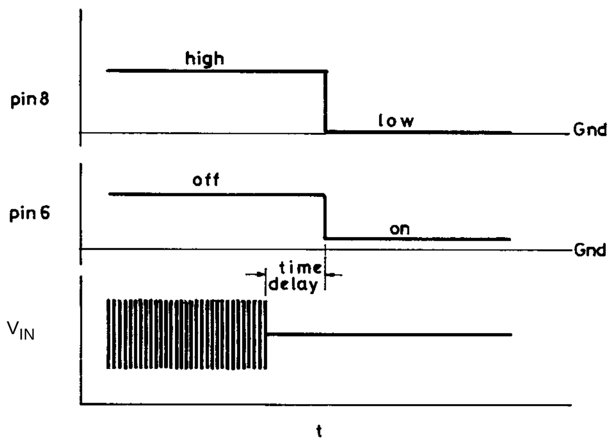
Parameter	Symbol	Conditions	min	typ	max	Unit
Circuit current	I_{CC}	f = 1 kHz, V_{IN} = –45 dB		6	12	mA
Output transistor saturating voltage	$V_{CE\ (sat)}$	I_6 = 600 mA		1.5	2.5	V
Output diode forward voltage	V_F	I_F = 600 mA		1.5	2.0	V
Output-off level in input equivalent	V_{IN}	f = 1 kHz	–43	–50	–54	dBm
Comparator-on level	V_{TH-H}		3.0	3.5	4.0	V
Comparator-off level	V_{TH-L}		1.8	2.2	2.6	V
Pin 8 high level	V_8 pin		0.45	0.55		V
Output transistor leakage current	I_{L-TR}				100	µA
Output diode leakage current	I_{L-Di}				100	µA

1. Description of external parts

C1	Input coupling capacitor	0.47 to 2.2 µF recommended.
C2	NF capacitor	Capacitance is reduced, so the off level in input equivalent becomes lower in the bass frequency range. We recommend 1 to 10 µF.
C3, R1	For designation of time delays	Any time delay can be obtained by adequate choice of C3 and R1. We recommend 150 k to 500 kΩ for R1.
C4, R3	Power supply ripple filter	
R2	Bias resistor	For diode when pin 8 is used to drive external transistors. A 1 kΩ resistor is recommended.

2. Individual pins and their operations





As shown above, when input level is raised and the pin 2 voltage reaches the V_{TH-H} level of the comparator, pins 6 and 8 turn over. (V_{IN} = –45 dBm).

- Pin 6 is for driving plungers, When it is on the "L" side, pin 6 turns on and can draw current up to 600 mA maximum (restricted by duty-cycle chart). It is not to be on continuously for more than 3 seconds.
- Pin 7 is a diode that prevents reverse voltages induced when the plunger is turned off from on.
- Pin 8 functions in phase with pin 6 and can drive external transistors (such as for MUTE).

3. Time delays and obtaining CRs
   When input signals that have been applied at a level not less than –45 dBm are removed, discharging occurs through the CR connected at pin 2, lowering pin 2 potential. A time delay is provided before the hysteresis comparator turns over.

$$\frac{E1}{E0} = -\frac{t}{e^{\tau}}$$

E0 : Initial voltage
E1 : Threshold voltage
τ : Time constant

Accordingly,

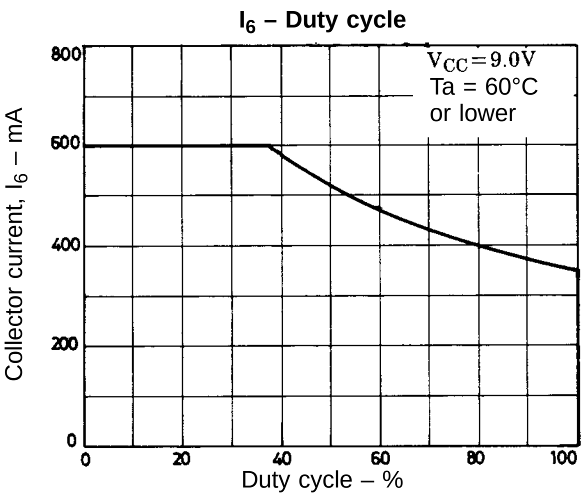
$$t = -\tau \ln \frac{E1}{E0}$$

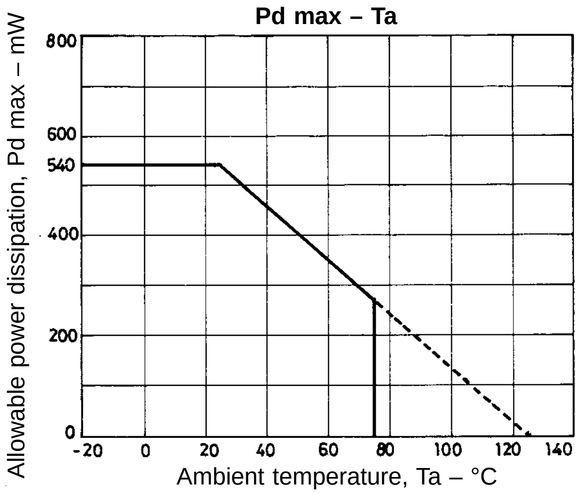
E1/E0, within the IC, is 0.26. A desired time is obtained by an appropriate choice of τ (τ = C3R1). Therefore, the time delay is obtained by the following formula:

$$t = 1.34 \times C3R1 \text{ (sec)}$$

We recommend 150 k to 500 kΩ for R when determining CR.

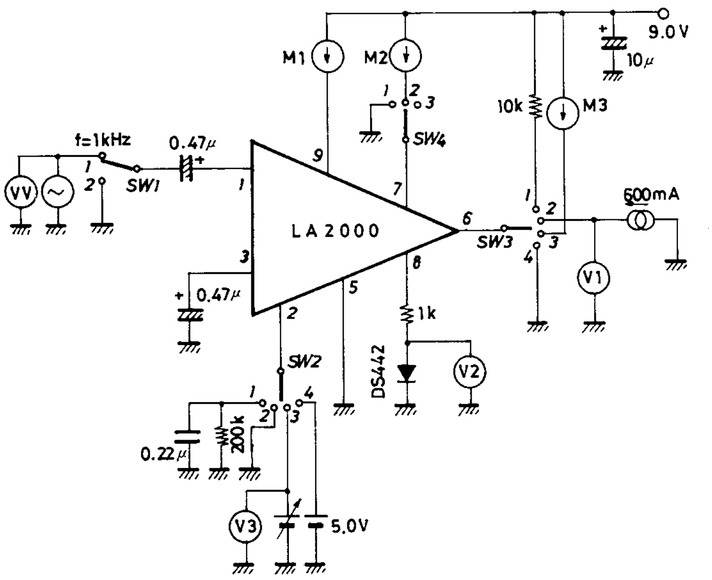
4. IC usage notes
   - Maximum ratings
     When maximum ratings are surpassed, destruction or deterioration may result. Use the IC in the range where the maximum rating is not exceeded.
   - Interpin short circuits and reverse insertions
     These cause destruction or deterioration of the IC: be careful when mounting on circuit board.
   - Voltage applied to pin 8 should never exceed pin 9 voltage.
   - The current flowing into pin 8 is to be 0.5 mA maximum.
   - Pin 4 is unconnected, but is not to be used for GND or an interconnecting terminal.





Note: I_C = 600 mA continuous is within 3 seconds
I_C = 300 mA continuous is within 30 seconds
I_C = 100 mA or less can be left on at all times.

Test Circuit

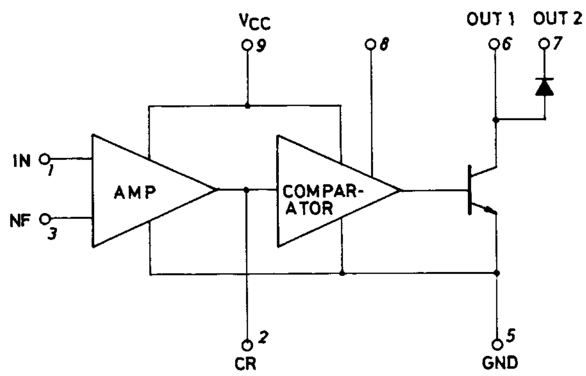


Unit (resistance: Ω, capacitance: F)

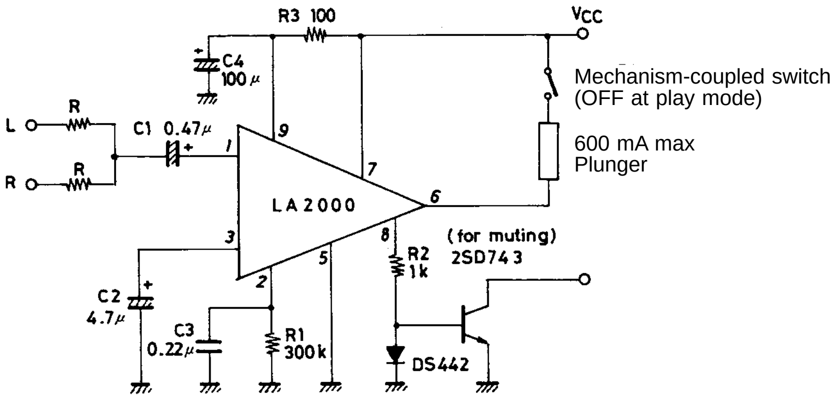
Test Conditions

Test items	Symbol	SW-1	SW-2	SW-3	SW-4	Conditions
Circuit current	I_{CC}	1	1	1	3	Measure current flowing into pin 9 at V_{IN} = –45 dB
Output transistor saturation voltage	$V_{CE\ (sat)}$	2	2	2	3	Measure V_{IN} at pin 6
Output diode forward voltage	V_F	2	4	2	1	Measure V_{IN} at pin 6
Output-off level in input equivalent	V_{IN}	1	1	1	3	Input level (V.V) when pin 6 turns over
Comparator-on level	V_H	2	3	1	3	Measure V3 When pin 6 turns over
Comparator-off level	V_L	2	3	1	3	Measure V3 When pin 6 turns over
Pin 8 high level	Vp-8	2	4	1	3	Measure V2 at pin 8
Output transistor leakage current	I_{TL}	2	4	3	3	Measure M3
Output diode leakage current	I_{DL}	2	4	4	2	Measure M2

Equivalent Circuit Block Diagram



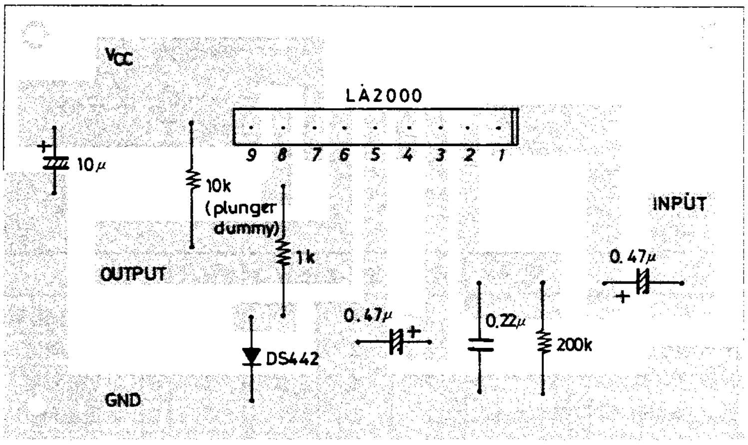
Sample Application Circuit 1



Unit (resistance: Ω, capacitance: F)

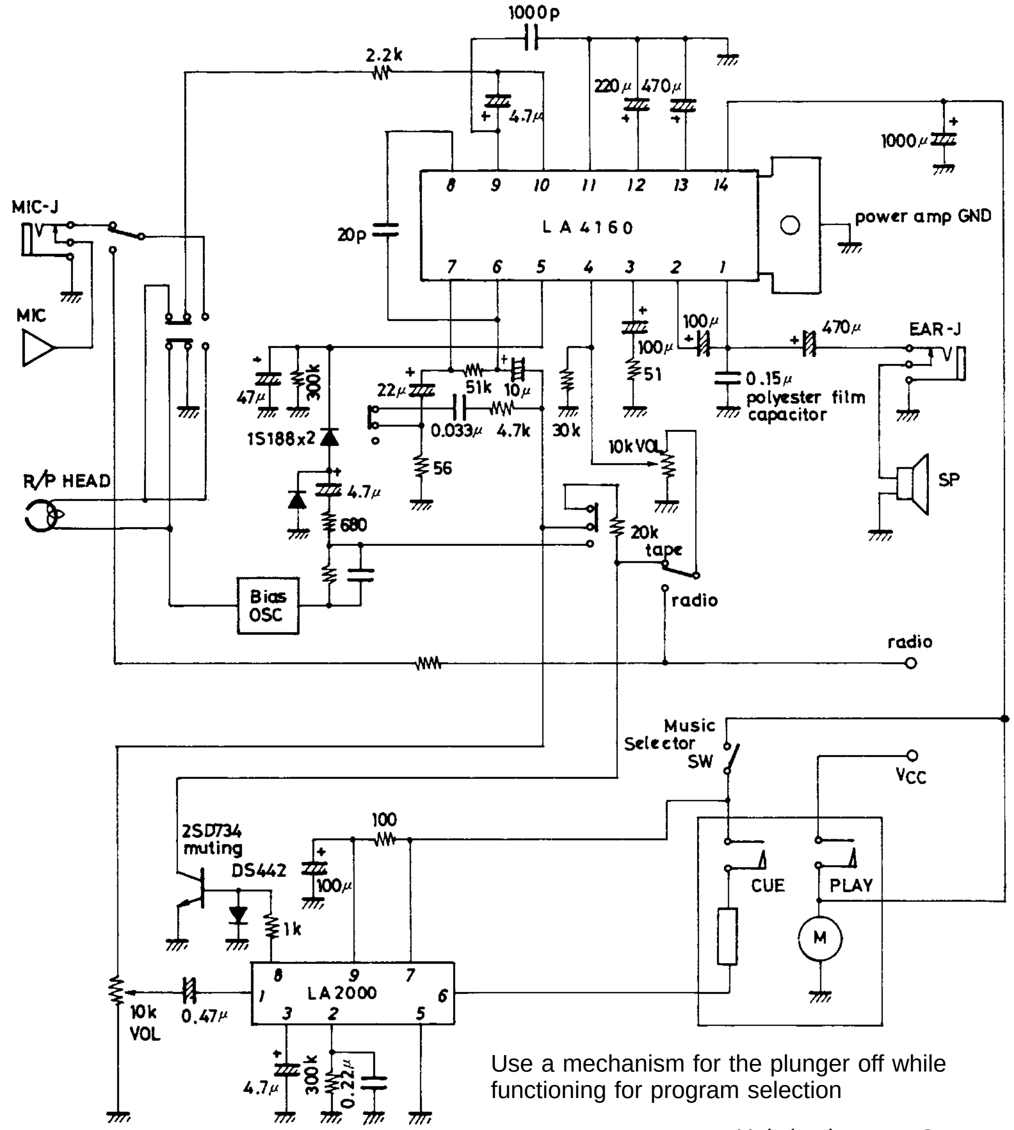
Pin 4 is unconnected but is not be used for GND or an interconnection terminal.

Sample Printed Pattern (copper foil side)



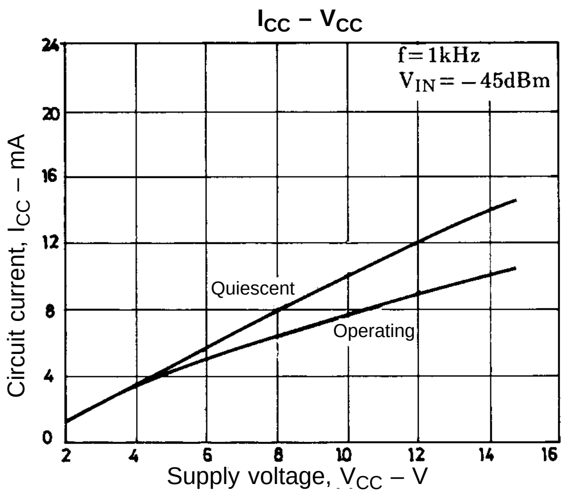
Unit (resistance: Ω, capacitance: F)

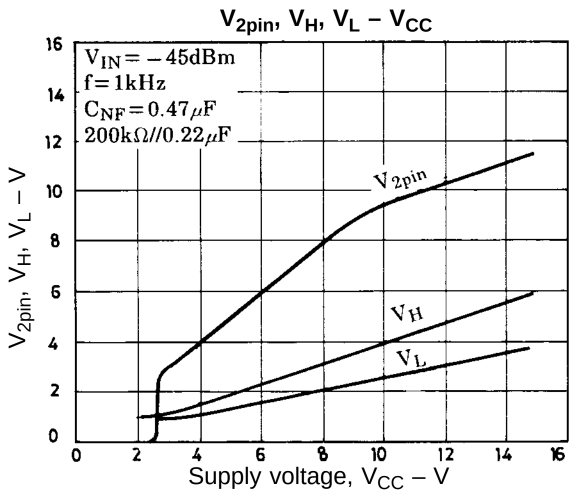
Sample Application Circuit 2



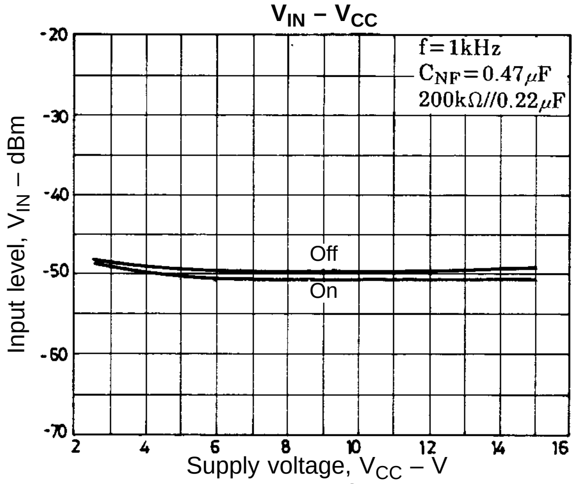
Use a mechanism for the plunger off while functioning for program selection

Unit (resistance: Ω, capacitance: F)

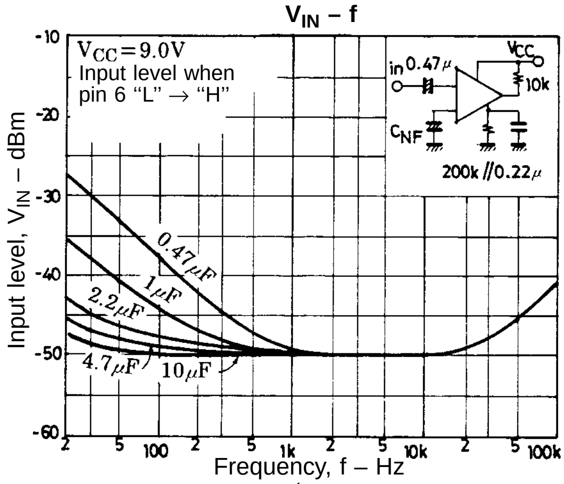




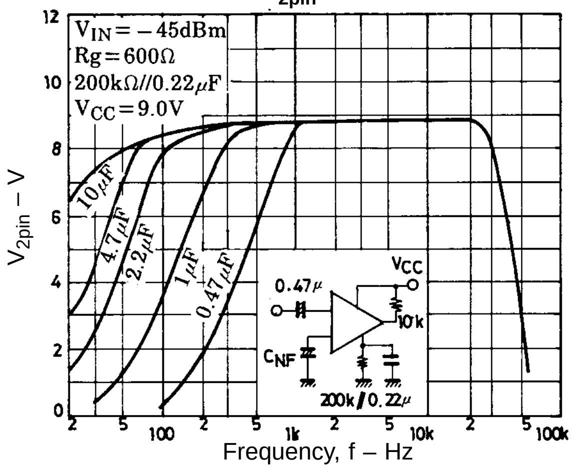
V_{IN} – V_{CC}



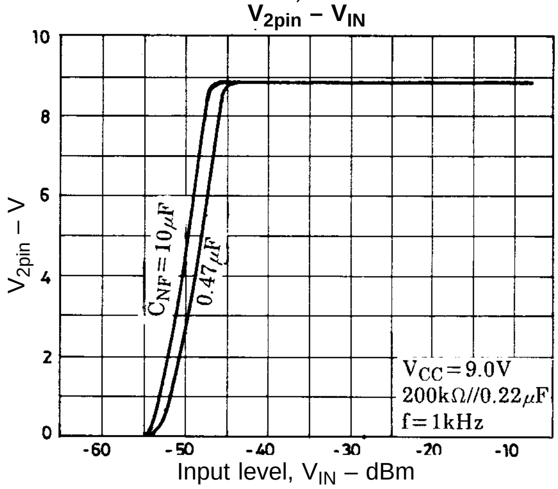
V_{IN} – f



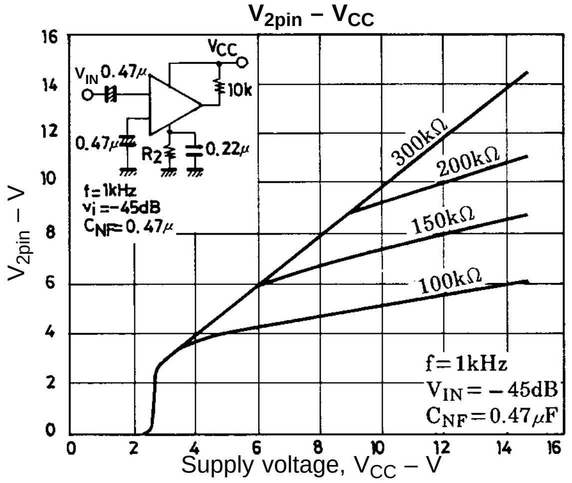
V_{2pin} – f



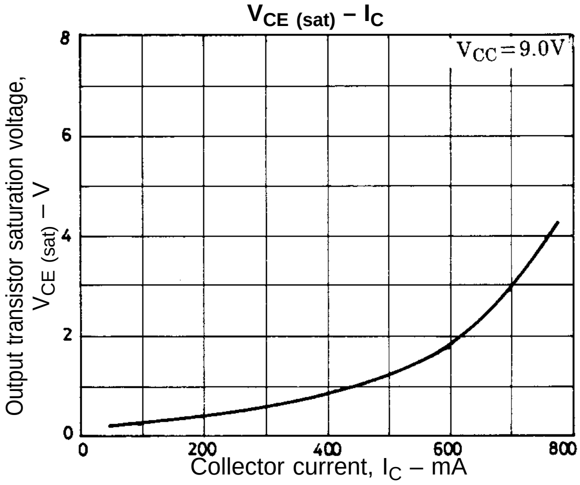
V_{2pin} – V_{IN}



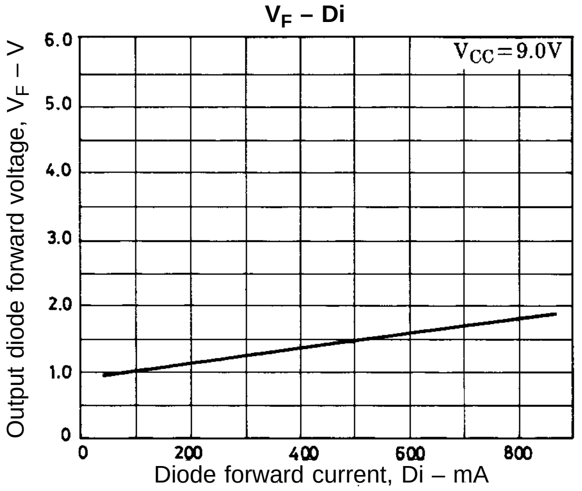
V_{2pin} – V_{CC}



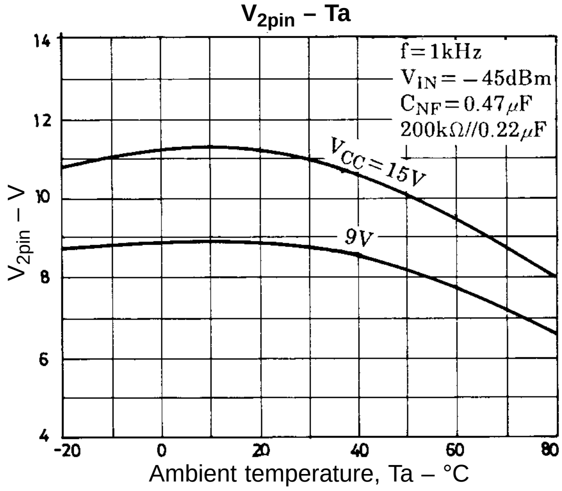
$V_{CE\ (sat)}$ – I_C



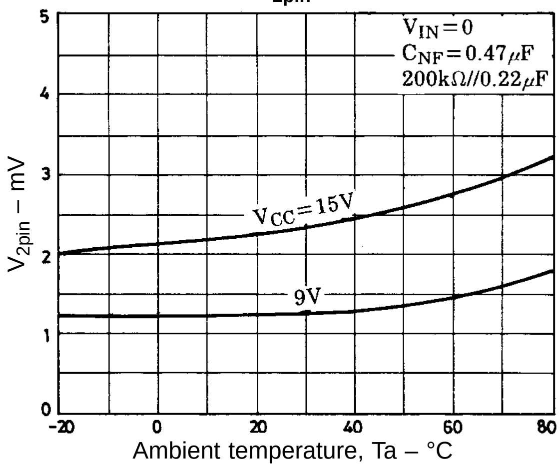
V_F – Di



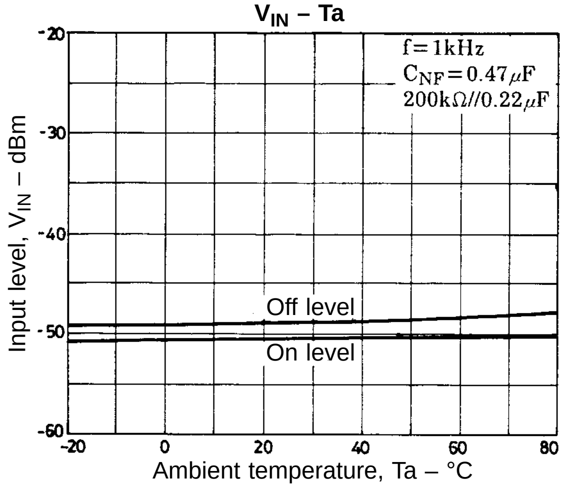
V_{2pin} – Ta



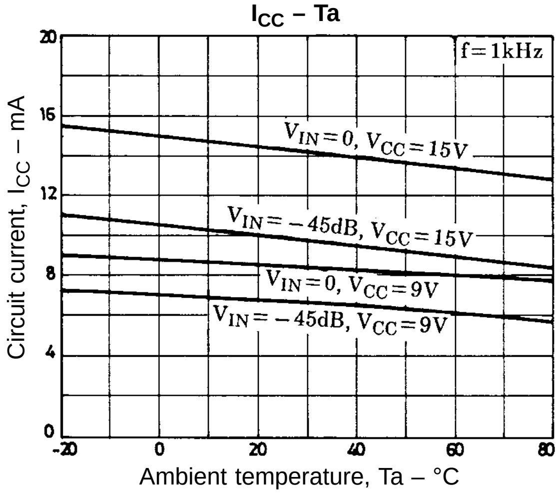
V_{2pin} – Ta



V_{IN} – Ta



I_{CC} – Ta



This catalog provides information as of May, 1996. Specifications and information herein are subject to change without notice.